

“Water is the most
critical resource
issue of our lifetime
and our children’s
lifetimes.

The health of our
waters is the principal
measure of how we
live on the land.”



Luna Leopold



KEY RESULT AREA 3

Linking Land and Water Resource Management

Desired Result: *The integrated management of land and water resources to sustain the quality of life in the Basin; preserving, restoring and enhancing ecological resources while recognizing the community's social and economic relationships to these resources.*

What does linking land and water resource management mean? Water is a finite resource, necessary for all life and upon which our social and economic structures depend. To achieve the most efficient, protective and sustainable use of water resources, growth and development decisions must reflect the following:

- The natural properties and cycling of water
- The interconnections of land and water
- The watershed as the natural framework for integrating water resource decisions

Why is linking land and water resource management important? Integrating water resource and land management is essential for balancing growth and development needs with water resource stewardship. Linking development and land management practices with water resource considerations can help attain optimal water use, improve water quality and maintain the quality of life in our communities.

The natural properties and cycling of water. Water is a limited resource that is cyclically exchanged between the earth and atmosphere. An integrated approach to water resource management and protection recognizes this dynamic hydrologic cycle as one of constant exchange through biological, chemical and physical processes. To achieve and maintain water quality sufficient for all the uses of the Basin's waters, the cycle must be honored. Focusing on the water-to-water point sources or direct discharges of pollution through "end-of-the-pipe" regulations and standards, while very successful, is not enough. Attention to the nonpoint sources of pollution, those diffuse sources that are distributed across the landscape, is necessary. This may mean altering development patterns and practices to improve efficient use of water resources and to maintain the function of landscape elements that are integral to the quality and abundance of water resources.

The interconnections of land and water must be incorporated into decision-making. The ecological interconnections of land and water resources have been acknowledged for decades, but quantifying some of the relationships remains a challenge. Understanding those interconnections, however, has not been adequately incorporated into decision-making. As a result, decisions continue to be made with unwanted environmental consequences. While the dynamic and cyclical exchanges of water have global patterns, they are most readily experienced and understood on a watershed basis.



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WHAT IS A WATERSHED COMMUNITY?

A watershed is the landscape that drains into a waterbody such as a stream or river. Unfortunately, political divides, patterns of commerce and transportation, and even groupings of similar ecological communities do not necessarily fall within watershed boundaries.

For the purposes of the Basin Plan, a watershed community encompasses the residents, landowners, businesses, voluntary associations and governmental units that make decisions about resources and development within a given watershed area. Members of each watershed community are both “upstream” and “downstream” stewards of their portion of the watershed.

Table 2: Examples of Point Sources, Nonpoint Sources and Potential Pollutants

POINT SOURCES	POTENTIAL POLLUTANTS
Sewage Treatment Plant and Industrial Discharges	Toxic Chemicals, Temperature, Nutrients, Organic Pollutants
Piped Stormwater Discharges	Metals, Bacteria, Garbage, Nutrients, Sediments
NONPOINT SOURCES	POTENTIAL POLLUTANTS
Septic Systems	Nitrates, Bacteria and Viruses, Household Chemicals
Roads and Parking Lots	Temperature, Hydrocarbons and Metals
Lawns, Farm Fields, Recreational Fields, Construction Sites	Pesticides and Herbicides, Nutrients, Sediment
Pets and Other Animals	Bacteria and Viruses, Nutrients

The natural framework for water resource management is the watershed. A watershed is the total area above a given point on a watercourse that contributes water to its flow, and includes the entire region drained by a waterway or watercourse that ultimately drains into a lake, reservoir, or bay. Watershed management recognizes the natural boundaries of water resources, the landscape elements critical to water supply and quality, and the avoidable disruptions that development and use can cause. A challenge lies in incorporating the watershed into existing decision-making structures, especially when political and natural boundaries are not aligned.

Successful watershed management planning depends on:

- Recognizing that water resources are cycled within a watershed
- Incorporating a watershed framework into our community, regional and statewide decision-making structures

A “watershed management plan” should direct comprehensive management of water and land resources within a watershed boundary. Unfortunately, political divides, patterns of commerce and transportation, and even groupings of similar ecological communities do not fall within, but more frequently cross, watershed boundaries. Given the natural and political constraints hindering the development and implementation of a watershed management plan, integrating water resource considerations into existing decision-making processes may be a more efficient way to link land and water resource management.

Since the vast majority of land management decisions are made at the community level, this Plan suggests focusing on integrating water resource considerations at the level of the watershed community. For the purposes of the Basin Plan, a watershed community encompasses the residents, landowners, businesses, volunteer organizations and governmental units that make decisions about resources and development within a given watershed area.

Communities that engage in watershed-based planning acknowledge their respective roles as “upstream” and “downstream” stewards of their portion of the watershed, and participate with other communities in the watershed and with partner agencies and organizations to achieve sustainable use and protect water resources. Community plans and ordinances should be adopted to reflect the common watershed goals for water resource and growth management.

Goals for Linking Land and Water Resource Management

- 3.1 Preserve and restore natural hydrologic cycles in the Basin’s watersheds.
- 3.2 Maintain and restore the integrity and function of high value water resource landscapes.
- 3.3 Fully integrate water resource considerations into land use planning and growth management.
- 3.4 Encourage development and redevelopment in areas where growth can improve the economic viability of local communities while providing for the protection and enhancement of the water resources of the Basin; discourage development and redevelopment where it may impair water resources and their related natural resources.
- 3.5 Physically and visually emphasize and strengthen the social, historic, cultural, recreational and economic connections of communities to the Basin’s waterways.

GOAL 3.1: Preserve and restore natural hydrologic cycles in the Basin’s watersheds. From absorption into the atmosphere as a gas, to the eventual recharging of lakes, streams, rivers, estuaries and aquifer systems, the natural hydrologic cycle is a continuous and dynamic process in equilibrium. Human disruption alters the cycle in many ways. Mitigating these disruptions requires us to address land development practices and regulation, as well as impacts from existing development.

Approximating natural seasonal flow regimes. In addition to gauging water budgets on a reasonable watershed scale (see the sidebar on page 20 “Defining the Appropriate Scale for Assessing Watersheds”) hydrographs should be established that reflect a natural range of flow variability. The goal is to develop and manage land in a manner that will approximate natural seasonal flow patterns.

Preserving soil health. Healthy soil infiltrates rainfall and enables recharge to support stream base flows and ground water supply. Disturbance or removal of soil inhibits infiltration and, if the remaining soils are compacted, may even prevent recharge from reaching water supply aquifers. Maximizing infiltration reduces runoff and thus minimizes flooding.

Maximizing natural vegetation. Vegetation helps to maintain soil stability, soil structure, and local temperature regimes (microclimates). When vegetation is removed, soil erosion and sedimentation in waterways increases. The removal of root systems can exacerbate soil compaction, affecting infiltration and recharge. A loss of vegetation also alters the amount of evaporated and transpired water to the atmosphere that normally occurs during photosynthesis, resulting in increased localized temperatures. This “heat island” effect is further intensified by large



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WHAT ARE HIGH VALUE WATER RESOURCE LANDSCAPES?

- Wetlands — soils, hydrology, vegetation
- Erodible slopes — geology, soils, slope
- Floodplains — areas subject to flooding within a waterway corridor
- Ground water recharge areas — soils, geology
- Headwater streams and associated drainage area
- Potential and existing public water supply sources (surface and ground water)
- Forested areas, especially those associated with headwaters and water supply areas
- Water bodies and their associated riparian corridors, habitat and floodplains

This list is meant to be illustrative, not all-inclusive, as each watershed may contain additional elements, that perform uniquely within that watershed.

amounts of paved surfaces. Not only is the protective shade of streamside vegetation lost, but the stormwater runoff from paved, un-shaded surfaces has a higher temperature to which native stream species may not be tolerant.

Replicating the natural timing and volume of stormwater.

Routing runoff from paved areas directly into waterways interrupts infiltration. This can result in flooding, severe erosion, temperature and quality changes, and diminution of water availability. Impervious cover and some stormwater collection practices

increase the volume and rate of runoff from storm events and may cause localized changes to ground water. Stormwater management must counter the flow and recharge alterations caused by development and ensure the recharge volumes equal those of natural conditions.

- Wetlands play an important role in the water cycle and in habitat provision. Landscape preservation and stormwater management programs need to consider the water requirements to maintain wetland survival.

GOAL 3.2: Maintain and restore the integrity and function of high value water resource landscapes.

Certain elements of the landscape are integral to the maintenance of the quality and availability of water resources. These landscape elements play specialized roles in water cycling and renewal.

Taking inventory of landscape elements within each watershed. Landscape elements that play a critical role in water cycling and renewal; high value water resource landscapes; should be identified at the watershed level. Steps to retain their hydrological function must be taken when land use, development, and preservation decisions are made.

Incorporating the location and functional importance of high value water resource areas or landscapes into natural resource inventory elements of local and county plans. These elements are important in the local establishment of optimal land use and density, for local and regional landscape protection efforts — such as open space planning

Functioning Riparian Wetlands



R. LIMBECK

— and for setting performance standards and management practices required for development. Community Master Plans should be revised to include current natural resource inventories inclusive of water resource landscapes, and to reflect zoning that protects high value water resource landscapes.

Including performance standards in local zoning and development ordinances. Local ordinances should incorporate plans and standards to conserve the water resource function of key landscape elements. Performance standards may differ from state to state and among regions of the Basin.

GOAL 3.3: Fully integrate water resource considerations into land use planning and growth management. Water resource considerations are the aspects of water resource use and protection that are related to land use and management. They include:

- Population and economic trends affecting water use
- Water availability and capacity of water supply systems, factoring in the need to include the protection of stressed and threatened source waters
- Availability and capacity of wastewater treatment
- Stormwater management measures needed to preserve and restore natural hydrological function within each watershed
- Protection or enhancement of the capacity of hydrological systems to assimilate point and nonpoint sources of pollution
- Direct and indirect impacts to natural systems
- Maintenance of the function of high value water resource landscapes
- The recreation potential of waterway corridors

Water resource, population and economic information should be assembled and analyzed on a watershed basis to aid discussions and decision-making for planning and permitting purposes. Water resource considerations should be integrated into the planning and growth management processes for communities and regions.

Considering water supply. Master plans, zoning and development ordinances should be consistent with the availability and capacity of local water resources. Some questions for communities to consider are:

- Are watershed communities dependent on surface or ground water supply?
 - To what extent is conjunctive use of ground and surface water possible?
 - Are current growth management plans and zoning realistic, given water supply availability?
 - Is there a current or projected water supply deficit?
 - What options exist for enhancing water supply to support expected or desired growth and what potential impacts accompany them?
- ☛ **It is also important to consider the potential threats to source water supplies when re-evaluating zoning and growth management plans.**

Considering wastewater treatment. Plans for wastewater service provision should be consistent with the growth management plans of the watershed communities and sensitive to the condition and capacity of water resources of the watershed. Decisions relating to on-site septic versus regional collection and treatment need to consider the capacity of the receiving water body to accept waste discharge, non-



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“Experts tell us that water management is best done on a watershed or Basin wide basis. This requires all who have a stake, whether in or outside government, to join in developing approaches tailored to regional needs.”

From Madeline Albright’s
Earth Day 2000 Speech,
“Global Water Security in the
21st Century”

discharge alternatives, plans for growth into the future, and the long-term capacity of water supply sources.

Typically, water supply planning and decisions about wastewater management are undertaken separately, often because the entities supplying the service operate independently of one another, and even independently of community plans. Many utility decisions for water and wastewater supply are made through utility commissions or boards that are not connected to community planning or to other agencies with interests in the provision of water services.

Failure to appropriately coordinate water provision and wastewater planning can lead to serious water resource issues. For example, in order to address the pollution of coastal waters large regional plants were constructed to treat and discharge effluent beyond the shallow bays and into the ocean. Coastal areas frequently rely on ground water for potable supply, often from confined aquifers with limited rates of recharge. Where permitted development depends on the capacity of the regional wastewater treatment facilities and does not consider the sustainability of water supply, communities may experience water supply issues, including shortages and saltwater intrusion into freshwater supply sources.

Respecting the assimilative capacity of hydrologic systems. Water bodies become the recipients of wastewater discharges and stormwater runoff. Healthy ecosystems tend to be resilient to some stresses, but only within limits. Understanding an ecosystem’s natural limits and linking these limits to water and land management is important for planning, and for setting goals for sustainable development. Just as communities and regional agencies consider the capacity of water and wastewater treatment plants and transportation networks, they should consider the assimilative capacities of the watershed’s hydrologic system. Alternatives to direct discharge to water bodies, and the establishment of water quality-based discharge standards are tools used to protect water resources.

Considering the direct and indirect impacts to natural systems. Comprehensive planning efforts examine how water is used and the direct impacts of water withdrawals, wastewater discharges, etc. Indirect impacts include issues such as:

- Increases in stormwater volume and changes in quality from expanding the amount of impervious surface
- Water quality impacts from maintenance activities, such as the application of de-icing agents on roads and parking lots or fertilizer or pesticide applications for agricultural activities, golf courses, and other recreational fields
- Lowering of ground water tables and impacts to streams and wetlands that can accompany increased pumping for irrigation or potable supply

These issues are all linked directly to land development, although they are not necessarily integrated into planning and project permitting processes.

Know your watershed. Establish what is known about local conditions by compiling an environmental inventory. The ability to accurately quantify local hydrological and ecological systems is hindered by limited data, a lack of modeling tools, and by fiscal resources. Often, a complete inventory of local conditions is necessary for improving planning and decision-making. However, there are characterization and assessment

tools available for planning purposes. Watershed communities can work together, sharing the costs associated with data collection and resource protection, just as they share the benefits of a healthy watershed.

- There is a need for local planning tools to assess the impacts of alternative development scenarios.

GOAL 3.4: Encourage development and redevelopment in areas where growth can improve the economic viability of local communities while providing for the protection and enhancement of the water resources of the Basin; discourage development and redevelopment where it may impair water resources and their related natural resources.

Choices about where and how development occurs, and how activities are managed on the landscape, affect the quality and availability of water resources. Prudent choices for growth and development incorporate water resource protection, and use fiscal resources efficiently. Governmental agencies, in partnership with private and non-profit organizations, can develop financial and regulatory incentives to encourage smart choices for growth, development, and redevelopment that do not impair water resources.

The following actions are necessary to accomplish this goal:

- Examine impacts and develop plans on a watershed, aquifer or regional basis
- Identify targeted areas for redevelopment to absorb growth where supporting infrastructure already exists or could be improved
- Develop criteria and incentives for coordinated review processes to facilitate development and redevelopment in appropriate areas
- Cluster new development to provide a mix of uses and activities, minimizing transportation impacts as well as landscape alteration
- Remediate contaminated sites and brownfields and return them to productive use
- Maintain current waterway and port infrastructure
- Employ regional approaches to sediment management
- Adopt ordinances and regulations designed to protect water and support natural resources through performance standards
- Incorporate natural features as functional design elements, e.g., linking constructed and natural wetland systems for stormwater and wastewater management
- Educate policy-makers, decision-makers and developers about water resources, the benefits they provide, and their community enhancement potential
- Restore the visual and physical connections of people to the waterways at every opportunity

GOAL 3.5: Physically and visually emphasize and strengthen the social, historic, cultural, recreational and economic connections of communities to the Basin's waterways.

What's the connection? Waterway landscapes appeal to all of our senses. Our history and culture are tied to our waterways. Our progress as a society has depended on water for transportation, power, commerce, recreation, and for poetic and artistic inspiration.



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“... the time has also come to identify and preserve free-flowing stretches of our great rivers before growth and development make the beauty of the unspoiled waterway a memory.”

From President Lyndon Johnson's "Message on Natural Beauty"

Unfortunately, many people take water for granted, possibly because they are disconnected from it. Drinking water comes from a pipe or a bottle. Buildings, abandoned industrial sites, or the protective railings of the bridges that traverse rivers and streams and the roadways that hug their shores often block views of waterways.

Experience is education. Education and knowledge are the foundation for stewardship, the concept of responsible care-taking based on the premise that we do not own resources, but are managers and are responsible to future generations for their condition. Providing the opportunity for waterway experiences is critical not only to the stewardship of water resources, but for the maintenance of some of the best aspects of human culture.

- ☛ It is important to acknowledge the historic roots of a community as well as its current and future social and cultural needs.

Providing the opportunity to experience our waterways. Re-establish access and visual connections where suitable, especially in association with redevelopment opportunities. In urban areas, projects for the redevelopment of abandoned waterfront areas should require elements designed to restore connections and relationships to the waterfront. Providing opportunity to experience our waterways may include commuter ferries, river walks and bike trails, boat access points, fishing piers and interpretive signage. Public lands should incorporate educational elements to foster stewardship.

We need to maintain what we have and to restore what we have lost. Without the opportunity to experience our water resources — especially for sheer enjoyment and wonder — we may remain disadvantaged, missing the inspiration of water.

Annual Delaware River Sojourn



DRBC PHOTO

Linking Land and Water Resource Management

Linking land and water resources management summary. This Key Result Area involves all aspects of water resource management, landscape management, planning and growth management, cooperation and coordination, education, and stewardship. Integrating the management of land and water resources challenges us to:

- Understand the physical, chemical and biological processes that define the water-land connection within a watershed
- Recognize the management strategy options necessary to achieve positive water resource and development outcomes
- Improve communication and planning within the watershed community
- Improve regional coordination among water resource and land use agencies
- Create public, non-profit and private partnerships
- Improve our collection, analysis and distribution of water resource information
- Develop and use analytical tools for local and regional decision-making
- Commit state, regional and local entities to engage in and support growth management and resource protection on a watershed basis
- Commit financial resources to support and coordinate local and regional planning and water resource protection efforts

The first three Key Result Area sections address the human and ecological uses of water, the critical land-water interface of waterway corridors, and the watershed landscapes and management decisions that can have long-term impacts on water resources. Clearly, the human component is a critical one. Individuals, businesses, organizations, and society, have the potential to effect important changes to our water resources through the land and water management decisions we make every day. The following section, “Key Result Area 4: Institutional Coordination and Cooperation,” focuses on how to manage that human component through our decision-making structures, formal and informal partnerships and agreements, sharing of information, ideas and data and, ultimately, by institutionalizing our relationships to the water resources of the Basin.

